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STORAGE LIFE OF CROAKER (*PSEUDOTOLITHUS SENEGALENSIS*) IN ICE AND AMBIENT TEMPERATURE

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*Storage life of croaker (*Pseudotolithus senegalensis*) was 20 days in ice and 12 hrs at ambient temperature. Rejection of the raw fish by a five-member taste panel was for strong fishy to sour odours and soft texture. Cooked samples were rejected based on sour and ammoniacal faecal odours with mushy texture. The predominant flavour was bitterness. The initial bacterial load was predominantly mesophilic in nature and included *Micrococcus*, *Bacillus*, *Pseudomonas*, *Coryneforms*, *Flavobacterium*, *Alteromonas putrefaciens* and *Enterobacteria*. Bacterial counts were within the range 10⁶ - 10⁷ on rejection and the principal spoilage organisms were *Pseudomonas* sp and *Alteromonas putrefaciens* during iced storage while *Bacillus* sp, *Pseudomonas* sp, *Alteromonas putrefaciens* and *Proteus* dominated the spoilage flora at ambient temperature. TMA and TVN proved to be reliable quality indices during ambient storage while their reliability as quality indices during ice storage was questioned.*

Keywords: *Pseudotolithus senegalensis*, croaker, storage life, ice, ambient

INTRODUCTION

Nigerian fishing industry is separable into artisanal sector, industrial sector and fish culture. The artisanal sector, in spite of its low technological development remains the backbone of fish production (Tobor, 1990). However, fish landed by the artisanal fishermen are generally not iced and if iced, insufficient ice is used to chill the catch. This is because ice is too expensive for the low income group and not readily available in rural fishing communities. On arrival at landing sites, fish have been exposed to high ambient tropical temperatures which lead to rapid quality deterioration. Marketing of fish is also done at ambient temperature which favours the growth of natural mesophilic microflora on tropical fish species. Knowledge of spoilage patterns of tropical fish and their shelf — life in ice and ambient temperature will therefore provide useful information for commercial transportation and marketing of fish in the tropics.

This study investigated the spoilage mechanisms of a marine fish, croaker (*Pseudotolithus senegalensis*). The study also determined the shelf life of the fish under ice storage and at ambient temperature.

MATERIALS AND METHOD

Collection and storage of fish samples: Two storage trials were carried out on medium sized (20 – 24 cm in length) croaker (*Pseudotolithus senegalensis*) caught off Lagos coastal fishing area in July 2003, by

fishermen and transported to the Laboratory of the Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos. Immediately after sorting the catch according to species, croaker (*Pseudotolithus senegalensis*) were washed with sea water and divided into 2 lots. The first lot was stored in ice in an insulated cooler with drainage hole, the ice being replenished daily. The second lot was kept in a plastic tray at ambient temperature ($28\pm 2^{\circ}\text{C}$)

Quality assessment of the uniced and iced fish was performed at 3 hrs and 3 days intervals respectively, taken at least ten (10) fish samples on each sampling occasion.

SENSORY EVALUATION:

Quality of the fish was determined using organoleptic acceptability as the main criterion. Raw acceptability and cooked attributes were evaluated by five (5) taste panelists using a simplified descriptive score card based on those described by Emokpae (1980) and Sorinmade and Talabi (1984). Raw samples were rinsed under the tap and presented whole to the taste panel. Samples were examined physically for general appearance, odour, colour of the gills, eyes, slime and stages of rigor. Flavour, taste and texture of the cooked meat was evaluated by steaming whole gutted fish in 2% brine for 10 min. Based on all these aspects, scoring was given on a scale ranging between zero and ten. Samples with a mean score more than 5 out of 10 were considered good and acceptable.

CHEMICAL ANALYSIS

The changes in total volatile nitrogen (TVN) and trimethylamine (TMA) content of the fish were determined by the Conway microdiffusion technique (Conway, 1968).

MICROBIOLOGICAL ANALYSIS

Isolation and enumeration of organisms: Ten (10) grammes of flesh (obtained near the belly) was added to 90ml sterile peptone water (0.1 w/v). Ten fold serial dilution of the suspension was made and 0.1 ml of the diluted suspension was plated in duplicates on standard plate count agar (OXOID) for total bacterial count, violet red bile glucose agar (OXOID) for enterobacteriaceae counts and iron agar (Jensen and Schultz, 1980) for H_2S - producers counts. Plates of iced and uniced samples were incubated at 20°C and 30°C for 72 hrs. respectively and the total number of cells per gramme of samples estimated.

Identification of Isolates: Colonies of isolates on plates were picked and subcultured on Nutrient agar (NA) to ensure purity of cultures. The different pure cultures were then transferred onto NA slopes and stored for further identification tests. The pure isolates were identified using morphological and biochemical characteristics (Sneath, 1966).

RESULTS

The fish retained most of their original freshness after 6 days and 11 days storage in ice and at ambient temperature respectively. The odour was fresh and seaweedy with no loss in outer appearance or sheen. Thereafter, changes in visual appearance became apparent. There was a gradual deterioration of the fish during icing while the deterioration was rapid during ambient storage. The fish was rejected by the taste panelists after 20 days in ice and 11 hrs. at ambient temperature (Table 1).

Rejection of raw fish by the taste panelists was mainly characterized by strong fishy to sour odours and soft texture. Cooked samples gave sour and ammoniacal – faecal odours with mushy texture. The predominant flavour was bitterness.

Figure 1 shows the results of the bacteria counts of the fish under storage. The changes in bacterial flora of croaker during storage are presented in figure 2. The initial flora was quite diverse. On rejection of the fish by the taste panelists, the composition of the bacterial flora changed. Principal spoilage organisms during icing were *Pseudomonas* sp and *Alteromonas putrefaciens* while *Pseudomonas putrefaciens* and *Bacillus* dominated the spoilage flora at ambient temperature.

Trimethyl amine (TMA) and total volatile nitrogen (TVN) contents of croaker showed slow increase during the early stages of storage. At later stages, the level increased more rapidly during ambient storage but fluctuated during ice storage (Table 2).

Table 1: Changes in the sensory values of croaker (*Pseudotolithus senegalensis*) during ice and

ambient storage

Storage time in ice days)	Mean Score	Storage time at Ambient temp (hrs)	Mean Score
0	09.6	0	9.5
3	9.0	3	9.0
6	8.0	6	7.0
9	8.5	9	6.0
12	7.5	12	5.0
15	6.0	15	4.0
18	5.5		
20	5.0		
21	4.5		

Table 2: Changes in TMA and TVN (mg/100g) value of croaker fish during storage in ice and ambient temperature.

Storage time in ice days)	TMA	TVN	Storage time at Ambient temp(hrs)	TMA	TVN
0	0.16	12.44	0	0.15	12.47
3	0.28	15.00	3	1.96	18.00
6	0.42	19.24	6	4.20	20.56
9	0.73	20.50	9	11.62	24.87
12	0.72	18.93	12	14.62	38.16
15	0.96	20.75			
18	1.32	21.56			
20	1.20	23.67			

DISCUSSION

Based on the judgments of the taste panelists and using the score of 5 as that value which indicates the fish to be just unacceptable, maximum storage life of croaker fish was found to be 20 days in ice and 12 hrs at ambient temperature (Table 1). The 20 days storage life of the fish in ice is longer when compared with storage lives of temperate fish species but within the ranges obtained for tropical species (Perna, 1955; Niinivaars et al; 1966, Hansen, 1972, Tejada et al, 1979; Bulter et al; 1981; Summer et al; 1984).

The longer shelf – life found in the tropical fish species is mostly explained in terms of the microflora found on tropical fish. The flora found on tropical species which are mesophilic in nature will be adapted to live at

higher temperatures, whereas the bacteria which cause spoilage of fish in ice are known to be psychrophilic in nature (Disney 1976; Shewan, 1977, Liston, 1979) and these constitute the bulk of flora on temperate fish species.

The initial total bacterial load of the fish was 5.3×10^3 counts/g of flesh. On rejection by the taste panelists, the level rose to exceed 10^6 counts/g maximum microbiological limit for fresh fish recommended by the international commission of microbiological standards for foods (IUMSF, 1978). The enterobacteriaceal counts were higher than the H_2S producers counts at all points during ambient storage as against ice storage, suggesting an important role of enterobacteriaceae during mesophilic spoilage.

As shown in fig. 2, the initial load was quite diverse with mesophilic bacterial population predominating. During ice storage, *Pseudomonas sp* and *Alteromonas putrefaciens* (psychrotrophs) increased in number and accounted for over 90% of the spoilage flora when fish were rejected by the taste panel. This suggests that, spoilage during iced storage is caused by *Pseudomonas sp* and *Alteromonas putrefaciens* irrespective of the original bacterial flora. Similar spoilage patterns have been reported for temperate fish (Levin, 1968, Shewan, 1977). Fish kept at ambient temperature spoiled rapidly and the flora is dominated by *Bacillus sp*, *Pseudomonas sp*, *Alteromonas putrefaciens* and *Proteus sp* respectively.

The TMA and TVN values fluctuated throughout during storage in ice and 10-15mg% (TMA) and 30 – 40mg% (TVN) limit of acceptability proposed for marine species (Connell, 1975) were never reached. The fluctuations in levels of TMA and TVN may probably be due to the washing effect of ice during storage.

The results obtained in the present study for ice croaker tend to confirm the observations that TMA and TVN are of questionable use as quality indices of some tropical fish (AMU and Disney, 1973; Lima dos Santos, 1981). However, TVN values increase near rejection, indicating that TVN may be useful as a measure of degree of spoilage rather than use to estimate the degree of freshness. On the other hand, TMA and TVN proved to be reliable quality indices during ambient storage. The contents increasing steadily from 0.16 and 12.47mg/100g reached 14.62 and 38.16mg/100g TMA and TVN respectively after rejection by the taste panel.

Statistical analysis showed a strong correlation (correlation coefficient, 0.98) between the total viable counts and the values of TMA and TVN at the storage conditions, meaning that the formation of TMA and TVN at the storage conditions is bacterial in nature thus the observation of the strong offensive odours by the taste panelists at rejection. The pronounced bitter flavour observed during the end of storage could be due to high formation of hypoxanthine (H_x) from autolytic degradation of nucleotide in the fish.

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